EXHIBIT 16

Baseline Ecological Risk Assessment for Non-Asbestos Contaminants (Excerpt) (April 2013)

FINAL

Baseline Ecological Risk Assessment for Non-Asbestos Contaminants

Operable Unit 3
Libby Asbestos Superfund Site
Libby, Montana

April 2013

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APPROVAL PAGE

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Operable Unit 3, Libby Asbestos Superfund Site, Libby, Montana
April 2013

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Executive Summary

Introduction

This document is a baseline ecological risk assessment (BERA) for non-asbestos contaminants in Operable Unit 3 (OU3) of the Libby Asbestos Superfund Site, located near Libby, Montana. The purpose of this assessment is to describe the likelihood, nature, and extent of adverse effects on ecological receptors in OU3 that result from exposure to non-asbestos contaminants released to the environment as a result of past mining, milling, and processing activities at the site. This information will be used by risk managers to decide whether remedial actions are needed to protect ecological receptors in OU3 from site-related non-asbestos contamination. Ecological risks from exposures to asbestos will be addressed in a separate document.

Site Characterization

Libby is a community in northwestern Montana that is located near a large open-pit vermiculite mine. The mine location is shown in **Figure ES-1**. Vermiculite from the mine contains a form of asbestos referred to as Libby amphibole (LA). Based primarily on concerns about asbestos exposures, the U.S. Environmental Protection Agency (EPA) listed the Libby Asbestos Superfund Site on the National Priorities List in October 2002. OU3 includes the property in and around the former vermiculite mine and the geographic area surrounding the mine that has been impacted by releases and subsequent migration of contaminants (including both asbestos and non-asbestos contaminants) from the mine. A preliminary study area boundary for OU3 is shown by the red line in **Figure ES-1**. This study area encompasses the forested area surrounding the mine, and includes all of the major surface water features in OU3, including Rainy Creek, which is the principal drainage for the site.

Aside from asbestos, the principal contaminants of concern at OU3 are metals that occur in the ore body. In addition, various chemical reagents were used to facilitate the separation or vermiculite from waste rock, and oil may have been used for dust suppression on mine roads. Thus, a broad suite of non-asbestos contaminants, including both inorganic and organic contaminants, may be present at OU3.

The mined area is heavily disturbed by past mining activity and some areas remain largely devoid of vegetation. Outside the mined area, most of OU3 is forested, with Douglas fir and lodgepole pine being the predominant species. The mine is located within the Rainy Creek watershed, which includes several creeks and ponds, as well as the tailings impoundment. Various terrestrial and aquatic species are expected to occur at the OU3 site, including several federally-listed and state species of concern.

Problem Formulation

Problem formulation is the systematic planning step for ecological risk assessment that identifies the major concerns and issues to be considered and describes the basic approaches that will be used to characterize ecological risks.

A conceptual site model (CSM) is a schematic summary of what is known about the nature of source materials at a site, the pathways by which contaminants may migrate through the environment, and the scenarios by which receptors may be exposed to site-related contaminants. **Figure ES-2** presents the CSM for exposure of each general ecological receptor group (fish, aquatic invertebrates, amphibians, terrestrial plants, soil invertebrates, birds, mammals) to mining-related non-asbestos contaminants at OU3. As shown, the following exposure pathways were evaluated quantitatively in this BERA:

- *Aquatic Receptors (fish, aquatic invertebrates, amphibians)* – Direct contact exposures with sediment and/or surface water.

- *Terrestrial Plants and Soil Invertebrates* – Direct contact exposures with soil and mine waste materials.

- *Wildlife Receptors (birds and mammals)* – Exposures by three primary pathways: 1) ingestion of contaminants in or on dietary items; 2) incidental ingestion of soil and/or sediment while feeding; and 3) ingestion of contaminated water.

Basic Risk Assessment Approach

Three basic risk assessment evaluation strategies were used to evaluate risks for ecological receptors as OU3 – the hazard quotient (HQ) approach, site-specific community evaluations, and site-specific toxicity tests. Each of these risk assessment evaluation strategies has advantages and limitations. For this reason, conclusions based on only one method of evaluation may be misleading. Therefore, the best approach for reaching reliable conclusions is to combine the findings across all of the methods for which data are available, taking the relative strengths and weaknesses of each method into account in a weight of evidence evaluation.

Data Summary

Data needed to support the BERA for OU3 have been collected as part of several investigations. Sampling of environmental media for non-asbestos contaminants has focused on surface water, sediment, soils, and mine waste materials, since these are the media most likely to have been impacted by site-related releases. Most samples were analyzed for metals and metalloids, petroleum hydrocarbons, and various media quality parameters. In addition, selected samples were analyzed for a broad suite of other chemicals, including volatile organic compounds (VOCs), semi-volatile

organic compounds (SVOCs), cyanide, pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and selected radionuclides.

Surface water and sediment samples collected from OU3 have been used to conduct site-specific toxicity tests for rainbow trout (*Oncorhynchus mykiss*) and aquatic invertebrates (*Hyalella azteca* and *Chironomus tentans*), respectively. In addition, direct observations of the fish and aquatic invertebrate communities and habitat quality were made at several locations in Rainy Creek.

Chemicals of Potential Concern

An initial HQ screen was completed as part of this BERA. The goal of the screen was to eliminate from further consideration any contaminants, media, or receptor groups for which the data indicate risks are clearly below a level of concern. Chemicals with concentrations above toxicity benchmarks were retained as chemicals of potential concern (COPCs) for further evaluation in the refined HQ evaluation. **Table ES-1** summarizes the list of COPCs identified in the initial HQ screen for each exposure medium and each receptor group.

Weight of Evidence Evaluation

In this BERA, three different lines of evidence are presented:

- Refined HQ Evaluations (Section 6)
- Habitat and Community Evaluations (Section 7)
- Site-Specific Toxicity Test Evaluations (Section 8)

Each of these lines of evidence has inherent advantages and limitations. Therefore, the BERA used a weight of evidence evaluation to develop risk conclusions, combining the findings across each line of evidence and taking the relative strengths and weaknesses of each line of evidence into account.

Table ES-2 summarizes the conclusions for each line of evidence, the confidence associated with each line of evidence, and the overall weight of evidence conclusion for each ecological receptor of interest at OU3. The risk conclusions for each ecological receptor group are discussed below.

For fish, the weight of evidence suggests that risks from non-asbestos contaminants in OU3 are likely to be minimal. However, the fish community evaluation showed that the density of large fish in Lower Rainy Creek is somewhat lower relative to reference and that smaller fish are absent. There are a number of habitat factors which might contribute to this reduction in fish density, but is not possible to determine the degree to which habitat factors are responsible, or if other factors (e.g., asbestos contamination) may also be contributing to this decline.

For aquatic invertebrates, the community evaluations in Rainy Creek showed that the aquatic invertebrate community ranked as unimpaired to slightly impaired and habitat quality may be a contributing factor to any observed effects. Although HQ values suggest that risks to aquatic invertebrates from chromium, manganese, and nickel in sediment were possible, the site-specific toxicity tests showed no adverse effects in exposed organisms. The weight of evidence suggests that risks from non-asbestos contaminants in OU3 are likely to be minimal.

For plants and terrestrial invertebrates, the single line of evidence available (HQ) indicated that the potential for risk from several metals (barium, cobalt, nickel, vanadium) in the mined area cannot be excluded. However, due to the conservative nature of the toxicity benchmarks used in deriving HQ values, results should not be interpreted as evidence that risk does exist.

For wildlife, the single line of evidence available (HQ) showed that risks to wildlife were either not expected or were likely to be minimal for nearly all COPCs for all receptors. The exception is potential risks to insectivorous wildlife from the ingestion of barium, manganese, and vanadium in aquatic invertebrates. However, due to conservative assumptions about bioaccumulation of these COPCs, the calculated HQ values are likely to be biased high and actual risks are lower. Thus, results should not be interpreted as evidence that risk does exist.

Uncertainty Assessment

There are a variety of sources of uncertainty in each line of evidence used in the BERA that need to be evaluated and considered when developing the weight of evidence and making risk management decisions. The uncertainty assessment discusses the uncertainties associated with the HQ evaluations (including uncertainties that impact the nature and extent evaluation, the exposure assessment, the toxicity assessment, and the risk characterization), the habitat and community evaluations, and the site-specific toxicity test evaluations for OU3.

The results and conclusions presented in this risk assessment should be viewed in light of these inherent uncertainties, and risk management decisions based on the risk assessment conclusions should be interpreted accordingly.

Section 10 – Weight of Evidence Evaluation

There are a number of different techniques available to ecological risk assessors for evaluating the impact of site releases on assessment endpoints and assessing whether or not risk management goals are achieved. In this BERA, three different lines of evidence are presented:

- Refined HQ Evaluations (Section 6)
- Habitat and Community Evaluations (Section 7)
- Site-Specific Toxicity Test Evaluations (Section 8)

As discussed in Section 3.2.4 and in the Uncertainty Assessment (Section 9), each of these lines of evidence has inherent advantages and limitations. Therefore, the best approach for deriving reliable conclusions is to combine the findings across all of the methods for which data are available to develop a weight of evidence conclusion, taking the relative strengths and weaknesses of each line of evidence into account.

Table 10-1 summarizes the conclusions for each line of evidence, the confidence associated with each line of evidence, and the overall weight of evidence conclusion for each ecological receptor of interest at OU3. The following sections provide detailed information for the weight of evidence evaluation.

10.1 Risks to Fish

Three lines of evidence are available to assess risks to fish from site-related non-asbestos contaminants: 1) refined HQ values based on measured concentrations of contaminants in site surface water; 2) site-specific surface water toxicity tests; and 3) site-specific fish community surveys. The assessment of each of these lines of evidence is discussed below.

It was not possible to utilize barium HQ values to draw conclusions about potential impacts to fish, because the underlying data used to develop the surface water TRV did not include any fish species. The refined HQ values for all other non-asbestos contaminants show that risks to fish from direct contact with surface water are not above a level of concern. This conclusion is supported by the results of the site-specific surface water toxicity test, which showed no adverse effects in exposed trout. However, the fish community evaluation showed that the density of large fish in Lower Rainy Creek is somewhat lower relative to reference and that smaller fish are absent. There are a number of habitat factors which might contribute to this reduction in fish density, but is not possible to determine the degree to which habitat factors are responsible, or if other factors (e.g., LA contamination) may also be contributing to this decline. Taken together, the weight of evidence suggests that risks to fish from non-asbestos contaminants in OU3 are likely to be minimal.

10.2 Risks to Aquatic Invertebrates

Three lines of evidence are available to assess risks to aquatic invertebrates from site-related non-asbestos contaminants: 1) refined HQ values based on measured concentrations of contaminants in site surface water and sediment; 2) site-specific sediment toxicity tests; and 3) site-specific aquatic invertebrate community surveys. The assessment of each of these lines of evidence is discussed below.

The refined HQ values for surface water suggest that, with the exception of barium, risks to aquatic invertebrates from non-asbestos contaminants in surface water are acceptable. Risks to aquatic invertebrates from barium in surface water were predicted to be severe and widespread, but there is low confidence in this conclusion because of uncertainties in the barium surface water TRV. The refined HQ values for sediment suggest that risks to aquatic invertebrates from chromium, manganese, and nickel in sediment have the potential to be moderate to severe. However, risk predictions for aquatic invertebrates based on HQ values are not supported by the aquatic invertebrate community results, which showed the aquatic invertebrate community in Rainy Creek as unimpaired to slightly impaired and that habitat quality may be a contributing factor to any observed effects. The aquatic invertebrate community results are supported by the site-specific sediment toxicity tests, which showed no adverse impacts to exposed aquatic invertebrates. While toxicity tests did not include maximum concentrations of COPCs in measured in sediments, concentrations in site sediment are within a factor of 2-5 of levels tested. Consequently, it is expected that any adverse effects on aquatic invertebrates, if they were occurring, would likely be minimal. In this weight of evidence evaluation, the aquatic invertebrate community evaluation and toxicity test conclusions are given more weight than the conclusions based on the refined HQ values. Thus, it is concluded that risks to aquatic invertebrates from non-asbestos contaminants in OU3 are likely to be minimal.

10.3 Risks to Plants and Terrestrial Invertebrates

Only one line of evidence (the refined HQ approach) is available to evaluate risks to terrestrial plants and invertebrates from non-asbestos contaminants in site soils and mine waste materials. The refined HQ evaluation suggests that several metals (barium, cobalt, nickel, vanadium) exist in soils and mine waste materials at OU3 at levels that are potentially toxic to terrestrial invertebrates and/or plants.

Based on the HQ line of evidence, the potential for risk to plants and soil invertebrates from these metals in the mined area cannot be excluded. However, HQ values above 1 should not be interpreted as evidence that risk does exist. For example, laboratory-based toxicity studies and field surveys at other mining sites (EPA 2001b; 2005b; 2010b) have shown that elevated HQ values alone are usually not sufficient evidence to conclude that metals in soil are toxic to plants or invertebrates. This is because the toxicity benchmarks (i.e., EcoSSLs; Efroymson *et al.* 1997a,b) that are utilized to derive

HQ values are intended to be conservative screening-level values. That is, if concentrations are below the screening level, toxicity will not occur, but if concentrations are above the screening level, this does not necessarily indicate that adverse impacts are occurring. The conservative nature of these toxicity benchmarks is evidenced by the observation that measured concentrations of several metals in reference soil samples are above the screening-level toxicity benchmark. Thus, there is low confidence in any risk conclusions based solely on HQ values.

10.4 Risks to Wildlife

Only one line of evidence is available (the refined HQ approach) to evaluate risks wildlife from non-asbestos contaminants in site media.

Several metals were identified as COPCs for wildlife receptors in one or more environmental media. Refined HQ calculations showed that risks to wildlife were either not expected or were likely to be minimal for nearly all COPCs for all receptors (including both terrestrial and aquatic wildlife). The exception is potential risks to insectivorous wildlife from the ingestion of barium, manganese, and vanadium in aquatic invertebrates. However, due to conservative assumptions about bioaccumulation of these COPCs, the calculated HQ values are likely to be biased high and actual risks are lower. Thus, while potential risks cannot be excluded, there is low confidence in any risk conclusions based solely on HQ values, and results should not be interpreted as evidence that risk does exist.